

Remarks/Arguments

Claims 1-7 were pending in the application. Claims 1-3 and 5-7 were rejected, and claim 4 was objected to. Claims 4, 5, and 7 were indicated as containing allowable subject matter, and would be allowed subject to being rewritten in independent form and correction in claims 5 and 7 of certain deficiencies under 35 USC 112.

Claims 1-7 are cancelled herewith without prejudice and are replaced by new claims 8-16, which include independent claim 8 and dependent claims 9-16. Claim 8 contains the limitations of former claim 1 as well as several further limitations which, cumulatively, patentably distinguish over the cited prior art. Dependent claims 9-12 are generally similar to the subject matter previously reflected in claims 2-7. Dependent claim 13 further quantifies the frequencies of the fluid pulses. Dependent claims 14-16 reflect in greater detail the Fig. 10 and 11 embodiment broadly covered by prior claims 1, 6, and 7 and present claims 8, 9, 12, and 13.

Claim 8, as well as the several claims depending therefrom, have been cast in the context of a fluid injection mechanism having at least one pulse valve. It is respectfully submitted that the novel details of the “at least one pulse valve” provide basic patentability to claim 8. Moreover, the context of the fluid injection mechanism affords basis for further claim development of the Fig 10 and 11 embodiment in which the novel characteristics of the pulse valve of claim 8 are recited in the context of a pair of such valves configured in a particular manner. Applicants’ attorney felt that this form of amendment, ie, cancellation of the prior claims without prejudice and replacement with “new” amended claims, was the “cleanest” manner in which to present the amendment.

Claim 8 is very similar to prior claim 1, and differs in the following ways. It now claims “A fluid injection mechanism (12; 12'; 112) including at least one pulse valve . . .”; and the further details of the “at least one pulse valve” include “one member (42; 142; 242; 40; 140; 240) of the pair of slotted members (40, 42; 140, 142; 240, 242) being mounted to allow limited axial displacement relative to the other” (lines 13-16); “ means (72; 172) for urging the one member (42; 142; 242; 40; 140; 240) of the pair of slotted members (40, 42; 140, 142; 240, 242) capable of said limited axial displacement into

close sealing relation with the other member of the pair” (lines 24-28); and the means for rotatably driving one member relative to the other does so at a predetermined speed “sufficient, in combination with the slots (44, 46; 144, 146; 244, 246) in the pair of members (40, 42; 140, 142; 240, 242)”, to provide successive pulses of the fluid medium at a high frequency (lines 31-35). It is submitted that these details clearly and patentably distinguish the fluid injection mechanism of claim 8 from the cited references, as will be discussed in greater detail below. Moreover, the Examiner’s rejection of prior claims 5 and 7 under 35 USC 112 because the recitation of “the opposed facing faying surfaces” lacked antecedent, has been obviated in the somewhat-comparable new claim 12 with the positive recitation of “to provide respective faying surfaces”.

The Haynes et al and Lim et al patents were separately applied in rejecting prior claim 1 as being anticipated under 35 USC 102. Applicants respectfully submit that new independent claim 8, which generally replaces prior claim 1, is now patentably different from either patent, either taken alone or from any teaching resulting from a proper and logical combination of those references.

Considering first the Haynes et al reference, there is disclosed a high speed rotary valve capable of providing fluid “perturbations” at a rate above 50 Hz, and typically 100 Hz to 1000 Hz. Importantly, however, the Haynes et al valve is not intended to fully close between perturbations. Rather, it is designed with an intentional gap or spacing between the rotary and stationary valve bodies to allow leakage. That spacing is presumably a constant to insure the desired leakage. Conversely, the present invention provides for one of the slotted members to be “mounted to allow limited axial displacement to the other” slotted member (Cl 8, lines 15 and 16). Moreover, there is provided “means (72; 172) for urging the one member (42; 142; 242; 40; 140; 240) of the pair of slotted members (40, 42; 140, 142; 240, 242) capable of said limited axial displacement into close sealing relation with the other member of the pair” (Cl 8, lines 24-28). This arrangement of “limited axial displacement” and “urging means” is intended to allow sufficient wobble for the mating face of one member to adjust or compensate for any non-uniformities in the opposite mating surface of the other member such that they can be in “close sealing relation” with one another under the influence of the “urging means” to assure a good

seal between fluid pulses. Clearly this structure and function of the present invention differ markedly from that of Haynes et al.

Attention is now turned to the Lim et al reference, which discloses a multi-way valve. The multi-way valve of Lim et al is intended for directing or controlling fluid flow in various different directions at relatively slow speeds. At no place does it disclose "A fluid injection mechanism (12; 12'; 112) including at least one pulse valve (24; 124, 122) for providing high frequency pulses of a fluid medium" (cl 8, lines 1-3). Indeed, nowhere is there any characterization of Lim et al as a pulse valve. It employs a stepper motor, which is characteristically used for accuracy of positioning rather than speed. Indeed, even the Haynes et al reference discussed above mentions in its "Background of the Invention" the limitations of various slow rotary-valve operating mechanisms. Applicants, on the other hand, require "means (70, 54, 52; 194) for rotatingly driving one member (42, 142, 242) of the pair relative to the other (40, 140, 240) at a predetermined speed sufficient, in combination with the slots (44, 46; 144, 146; 244, 246) in the pair of members (40, 42; 140, 142; 240, 242), to provide successive pulses of the fluid medium at a high frequency" (cl 8, lines 29-35). This is specified further in claim 13 in which the frequency of the successive fluid pulses "approaches or exceeds 100 Hz". The disclosure of the present application is clear in its requirement of a fluid injection mechanism having a pulse valve that provides high frequency fluid pulses (emphasis added). Such is simply neither the objective nor the capability of Lim et al.

As discussed above, neither Haynes et al nor Lim et al, nor for that matter the other cited references, disclose a fluid injection mechanism having a pulse valve that provides high frequency fluid pulses and is structured in the manner now recited in new claim 8. Moreover, it would not be obvious or appropriate to combine the teachings of selected parts of those references to attempt to arrive at the claimed invention because their respective character's are so different. For instance, Lim et al is concerned with a stepper motor driven rotary multi-way valve that is believed to be inherently speed limited, is not concerned with providing pulses but instead directing fluid flow, and is concerned about a good seal existing between the valve bodies. On the other hand, Haynes et al is concerned with the high-speed generation of fluid perturbations using a valving system that specifically wants leakage rather than a good seal. For at least these reasons, it would

not be obvious to look to a combination of Haynes et al and Lim et al for the selected features required to render claim 8 as obvious.

Beyond the new independent claim 8 which applicants believe to be patentable for the aforementioned reasons, there are also the additional characteristics provided by dependent claims 9-16. Claims 10 and 11 are specific to the Fig. 8 embodiment, claims 14-16 are specific to the Figs. 10 and 11 embodiment, and the remaining claims are generic to both embodiments.

Accordingly, it is respectfully submitted that the claims, as now amended, clearly and patentably distinguish over any appropriate combination of teachings contained in the applied references. Entry of this amendment, and favorable reconsideration and an indication of allowance are respectfully requested. In the event issues remain and the Examiner feels the prosecution might be advanced by further discussion, the Examiner is respectfully requested to contact applicants' attorney at the number below.

Respectfully submitted,

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